REVIEWS.

GENERAL PHYSIOLOGY: AN OUTLINE OF THE SCIENCE OF LIFE. By MAX VERHORN, M.D., Ph.D. Translated and edited by FREDERIC S. LEE, Ph.D. London: Macmillan & Co., Ltd.

SUCH an important subject as general physiology is ever of interest, not only in the study of natural science, but in practical medicine as well.

"Physiology has for its task the investigation of life," says the author. The achievements and discoveries, great as they have been, have been chiefly with the gross chemical and physical phenomena of the body—the mass effects of large parts of the body and the special activities of the different parts. However brilliant these may have been, they fail to explain the *elementary* vital phenomena—the general vital problems. When we inquire into these elementary vital phenomena we are led to the cell, so that cell-physiology has before it an enormous field. It is pointed out that the reason cell-physiology has been neglected is because we do not make physiology sufficiently comparative, and the necessity of making it more comparative is strongly urged.

We cannot agree with the author in saying "the science of physiology of the organs has passed the culminating point of its development." This may be with some organs, but certainly the great progress made in the study of internal secretions in recent times, and in the investigation of the nervous system since the discovery of the neuron, does not bear this out. While it is true that the lower forms of life have not received proper attention, yet it does not follow that greater advance could have been made by first investigating the simple forms of life and then going to grosser activities and the most highly specialized tissue or organ, instead of the reverse order. Certainly our knowledge of contractility could not have been obtained from the amœba as it has been from highly specialized muscles. The same is true of irritability and other properties of protoplasm.

After showing there is no *specific* vital force, the author speaks of how the term is generally used at the present time as a special expression of chemico-physical forces, but adds: "A return to the ill-reputed word, which arouses a well-defined prejudice, is simply to give up the advantage afforded by the hard-earned conviction of the unity of cause in all nature." No suggestion of a better term is given. If we do not express those obscure complex processes of cells which are not yet understood as vital activities, what are we to call them? Certainly as the word is generally used to-day it has nothing to do with the old "vitalism."

In dealing with the composition of living substance attention is called to the frequent mistake of considering protoplasm as a chemically unitary substance, and it is further added, "our conception of protoplasm should be a comprehensive morphological and not a chemical one."

Regarding the nucleus, the same thing is true, and we are glad to see it pointed out that there are four substances quite constantly present in nuclei. Particular emphasis is laid upon the undesirability of applying the chemical term *nuclein* to the morphological constituent *chromatin* of the nucleus. There are different kinds of nucleins, and as we know so little about them, we should be very careful not to confuse chemical with structural terms, for what we extract from a great mass of cells may be quite different from what we see under the microscope. As the author states, the building of the bridge between chemistry and morphology, and particularly with the nucleus, is an extremely difficult undertaking.

After discussing the different views regarding the centrosome, he concludes that it is a special and not a general constituent of the cell, for the reasons that it is impossible to find it in many cells, especially unicellular organisms, and when present it is not known to take part in any other vital phenomena than those of fertilization and reproduction.

Concerning the ground substance of protoplasm, the view supporting the elementary granules of Altmann is shown to be untenable in a very emphatic way. This, however, does not include the changes occurring in gland cells during secretion. After considering the views formerly held regarding the finer structure of protoplasm (the active, contractile framework—spongioplasm—and the inactive fluid—hyaloplasm—held in its meshes), the author adduces arguments, and quotes the work of Berthold and Bütschli to prove that protoplasm is homogeneous and fluid in nature. It seems strange now that the view regarding spongioplasm and hyaloplasm should have remained unchallenged for so long a time. In the endeavor to get at the basis of life, biologists and histologists disregarded the change taking place with the death of the cell, and particularly the action of fixation agents. This illustrates the extreme care required in the study of cell-physiology, and recalls the warning of Flemming regarding artefacts. The homogeneous, fluid nature of protoplasm has been still more fully established through the works of Schwarz and of Fischer and the recent investigations of Hardy. In view of these researches it is, perhaps, not too much to wonder how our present ideas about the structure of the nucleus and centrosome will stand the test of such methods of investigation.

In discussing the differences between organisms and inorganic bodies the author regards metabolism as characteristic of the living organism, but says it only distinguishes living from dead organisms, and that "metabolism is not confined to organisms, but occurs also among inorganic bodies" (p. 125). An example is given of the formation of concentrated sulphuric acid by mixing nitric and sulphurous acid. The sulphurous acid withdraws one atom of oxygen from the nitric acid to form the sulphuric acid, while the nitrous acid so formed takes up oxygen from the air to form nitric acid again.

We must take issue with the use of the word metabolism for such changes in inorganic chemistry, believing that the term should be used solely to denote the obscure chemical changes that occur in protoplasm. It is true that in the example given there is a continuous change of material, a constructive and a destructive change as well as oxidation, but the change is much simpler and occurs at one bound, and does not occur gradually, with various stages, in which there is a rearrangement of atoms and radicals. The changes in the cells are so complex, so obscure, that it seems well to restrict the use of the word metabolism to these changes.

Later, in discussing the way in which enzymes act, the same example in inorganic chemistry is given again as an illustration to show how bodies may be continually altered chemically and continuously re-formed immediately, so as to appear to remain unchanged. This illustrates very well the way enzymes probably act, but does not explain metabolism.

In summarizing the discussion of living and lifeless substance it is stated (p. 136): "We may thus give expression to the problem of all physiology—*the life-process consists in the metabolism of proteids.*" It is true the possession of the proteid molecule is a definite distinction of organisms, but the *life-process* involves not only the changes in these proteids, but also the oxidation of other organic substances (fats and carbohydrates as well as handling the inorganic bodies in these processes). It is true, as is pointed out later in dealing with the mechanism of life, that the changes occurring in proteids are much more complex than the changes occurring in other organic bodies, and cannot be simulated outside the body; but the process of life includes the *entire metabolic process*, and not merely the metabolism of proteids.

The book is splendidly written, and presents so many suggestions, with a thorough discussion of vital problems treated in such a masterly way, that it is a pleasure to read a work of its kind in these days of specialism. Such a collection of facts treated in a broad and scientific way should cause the book to be read by everyone at all interested in the science of life.

The text is very fully illustrated by beautiful plates. The work of translating and editing has been most admirably performed.

W. S. C.

TREATISE ON HUMAN PHYSIOLOGY. BY HENRY C. CHAPMAN, M.D. Second edition. Philadelphia and New York: Lea Brothers & Co., 1899.

THE general plan of this work is the same as in the first edition, the author stating in his preface that, aside from the plan, the book has been recast. A very striking and disappointing feature of the work is the absence of separate chapters on metabolism and secretions—particularly internal secretions External secretions are rather briefly treated—saliva with digestion, milk with the skin, and so on. The arrangement of giving the nervous mechanism of different functions only with the nervous system seems undesirable. As an example, the nervous mechanism of the secretion of saliva is given in the last part of the book with the cranial nerves, while no reference is made under the secretion of saliva, early in the book, to those pages. The nervous mechanism of the circulation and of respiration is likewise given with the cranial nerves. Naturally, when these subjects are fully treated in one place there must be some repetition in treating of the nervous system, but this is better than dividing the subject as in the work before us, where the student would largely lose the connection. As an example, the circulation is treated of in three different places, the nervous mechanism of the heart being given with the cranial nerves, that of the bloodvessels with the sympathetic system. As a result, the depressor nerve is dis-